

## ***Interactive comment on “H<sub>2</sub>SO<sub>4</sub>-H<sub>2</sub>O-NH<sub>3</sub> ternary ion-mediated nucleation (TIMN): Kinetic-based model and comparison with CLOUD measurements” by Fangqun Yu et al.***

**Anonymous Referee #3**

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The kind of model introduced in this paper is definitely needed in atmospheric new particle formation research, so I am in principle in favor of publishing this work. I have, however, a few concerns that should be addressed before accepting the paper for publication.

I am not fully comfortable with the current structure of the paper. Sections 1 and 2.1 provide a nice introduction and background for this work. Section 2.2 is a compact description of the model and fine as well. Section 2.3 is, however, a mixture of technical details, model evaluations and scientific results/findings. I would prefer separating these issues to the extend possible. For example, the technical details related to the

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used thermodynamic and other data as well as QC calculations could be put into a separate Appendix/Appendicies. Such details are a very important part of this paper, but not of major interest to most of the readers.

The authors state that a detailed description of QC calculations will be reported in separate papers. The authors should be very careful in this regard: this paper needs to have enough material to justify the obtained results.

Minor issues:

Please add to the text (line 197) that PH<sub>2</sub>SO<sub>4</sub> refers to gas-phase production of sulfuric acid (in the atmosphere, sulfuric acid/sulfate can also be produced in liquid/aerosol phase).

The given ammonia concentration levels (beginning of section 2.4.1) should be backed up with suitable references. The authors should better justify the statement that small ternary clusters can be considered to be in equilibrium with ammonia. Mentioning solely the typical ammonia concentrations is not enough.

CLOUD should be defined also in the abstract.

There are a small number of grammatical issues that should be corrected, e.g. indicating (line 64), a nucleation model (line 67), did not (line 107), a similar pattern (line 296), the s=a pathway (line 367), even when they (line 384), under the condition??? (line 559).

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